Class 7: Sets

Schedule

Everyone should have received their comments and grade on PS1 yesterday. Please make sure to read the comments posted on the website about how PS1 was graded.

Problem Set 3 is due **Friday at 6:29pm**.

I will have "make-up" office hours tomorrow (Wednesday) 3:30-4:30pm (in addition to my usual Wednesday 1-2pm office hours). There have been some adjustments to the office hours schedule, please check the calendar.

Notes and Questions

What is a *data type*? What are the differences between a *mathematical data type* and a data type in your favorite programming language?

A **set** is an unordered colection of objects. A set is defined by its membership operation: $x \in S$ is true if x is in the set S.

Set Operations

Subset: $\subseteq$ (note that this does not mean *strict subset*)

$$A \subseteq B \iff \forall x \in A.\_\_\_\_ \in \_\_\_\_.$$

Set Equality: =

$$A = B \iff A\_\_\_\_B \wedge B\_\_\_\_A.$$

Set Union: $\cup$

$$\forall x.x \in A \cup B \iff x \in A\_\_\_\_x \in B.$$

Set Intersection: $\cap$

$$\forall x.x \in A \cap B \iff x \in A\_\_\_\_x \in B.$$

Set Difference: $-$

$$\forall x.x \in A - B \iff x \in A \wedge x \notin B.$$

Set Complement: $\overline{S}$

$$\forall x.x \in D.x \in \overline{A} \iff x \notin A.$$

(D is the "domain of discourse", the universe of all objects under discussion.)

Russell's Paradox

$$S_R = \text{ the set of all sets that are not members of themselves}$$

Is $S_R \in S_R$?

Set Practice

Here are some practice problems involving sets. We won't go through these in class, but you should ask questions about any are unclear. (At least a few of these will be on Exam 1.)

1. Define $A \subset B$ (strict subset).

2. Prove $A \cup B \equiv B \cup A$.

3. Prove $A - B = \emptyset \iff A \subseteq B$.

4. Prove $A = B \iff (\forall a \in A.\, a \in B) \wedge (\forall b \in B.\, b \in A)$.

Danny Lewin

See the web version for links to articles on Danny Lewin.

> *In true Danny form, he fought back against the terrorists in an effort to defend the stewardesses and the cockpit. To this day, those of us who knew him well can't figure out how only five terrorists managed to overpower him. During his short life, Danny made extraordinary contributions to the internet and to computer science through his work in algorithms and complexity theory. The impact of his work will be felt throughout the hi-tech industry for many years to come.* (from Tom Leigthon's remarks to commemorate naming of the STOC Best Student Paper Award in honor of Daniel Lewin, 19 May 2002.

